Bill Nye the Science Guy

Space Exploration

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Implementation Guide

Welcome to Disney's Bill Nye DVD collection! With the help of this Guide you can bring instructional DVDs into your science curriculum.

What's on the DVD?

Bill Nye DVDs expand the educational features of *Bill Nye the Science Guy* programs. Each DVD provides students with science content through video clips aligned with *National Science Education Standards (NSES)* and a host of other resources.

Short video clips aligned with the NSES provide a unique opportunity for you to enhance your lessons using DVD technology. Now you can show a video clip, or even short segments of a clip, on command. But there are a host of other features, too! See the chart below for a summary.

From the Main menu, there are three chief sections:

Feature	Description
Watch Program Menu	From this menu, you can play the program straight through or use the clips to customize your viewing.
Teacher Support	From this menu, you can access this Teacher's Guide, the Glossary, Internet Links, and the Quiz.
Bonus Materials	Use this menu to try a different discussion starter, download a special screen-saver, or check out never-before-seen footage.

From the Watch Program menu, you can:

Feature	Description
Play Program	Play the entire program from start to finish.
Bilingual Mode	View the entire program or clips in English or Spanish.
Glossary Mode	Make links to Glossary terms appear during the program.
Program Overview	View the program introduction, in which Bill discusses the topic covered.
Try This	Show students demonstrating science concepts.
Way Cool Scientist	Meet a real scientist who talks about his or her area of study.
Bill's Demonstration	Look at a science demonstration conducted by Bill Nye.
Music Video	Enjoy a short music video that summarizes the topic in an age-appropriate and entertaining manner.
Science Standards	Take advantage of short video clips from the program, which are aligned with National Science Education Standards.

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From the Teacher Support menu, you can:

Feature	Description
Science Quiz	Give students a quiz to take independently or as a class. Seven to ten quiz items are aligned with the National Science Education Standards. The items are in multiple-choice or true-false format. Each wrong answer links to a standards-aligned video clip. At the end of the quiz, a scoring function reveals the number of correct initial answers.
Glossary	Check out definitions of key terms and view video clips that reinforce the concepts.
DVD Features	View a quick overview of the features found on the DVD.
Teacher's Guide	Print out or view this comprehensive Teacher's Guide in PDF format.
Internet Link	Link to the Bill Nye area of Disney's Edustation Web site, where you can find links to Internet sites related to the content of each Bill Nye program.

From the Bonus Materials menu, you can:

Feature	Description
Bonus Material	Find out what *wasn't* in the episode! In most cases, there's more of the Way Cool Scientist interview, Bill Nye outtakes, and an extra discussion starter.
Additional Clips	See trailers of related DVDs and videos.
Screen-Saver	Download this cool screen-saver for your computer.

The Planning Process

This Guide provides a Lesson Planning Worksheet (see page 12), which can assist you in setting up your instruction around a topic. The following sections of this Implementation Guide are offered to assist your planning process:

- **Determining Objectives and Linking to Standards**
- **The Learning Cycle**
  - **Explore**
  - **Apply**
  - **Extend**
  - **Assess**

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Determining Objectives and Linking to Standards

1. The NSES Teaching Standard A states that science teachers must "select science content and adapt and design curricula to meet the interest, knowledge, understanding, abilities, and experience of students."

   The NSES recommends that teachers "integrate . . . a practical structure for the sequence of activities, and the content to be learned." The primary instructional model recommended by the NSES is inquiry into authentic student-generated questions about natural or designed phenomena. Since most state and local standards documents were derived from the NSES, you will find that your local and state standards match closely with content standards in the Bill Nye DVD.

   Each DVD contains a menu of clips that are aligned with the NSES. You can review the standards and their aligned clips in the Science Standards menu under Watch Program. Also, the Standards listed on page 10 of this Guide allow you to look at additional NSES content standards that are addressed on the video. Here's an example of the content standards and clips aligned with the Bill Nye DVD entitled *Blood and Circulation*:

Life Science Standards (NSES) Addressed in *Blood and Circulation*

Life Science:
Structure and function in living systems

- **Living systems at all levels of organization demonstrate the complementary nature of structure and function.**

  Aligned clips:

  - **1 Blood vessels**
  - **2 Heart pump and bloodstream**
  - **3 Heart valves and blood circulation**
  - **4 White blood cells**
  - **5 Capillaries**

- **The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection.**

  Aligned clips:

  - **6 Heart pump**
  - **7 Heart muscle**
  - **8 Pumping blood to brain**

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2. Determine your objectives for the lesson and how these objectives address the standards.

Sample Objectives for *Blood and Circulation*

In this activity students will:

- **Observe and describe a body system responsible for supply and transport.**
- **Use this information to define a body system.**
- **Ask questions about the circulatory system.**
- **Explain how structure complements function in organs of the circulatory system.**
- **Cite examples of current research related to this system.**

3. Design a learning cycle of instructional experiences and assessments for the students to engage in that will help students meet these standards. Students may be given teacher-planned investigations or may be guided to design their own investigations.

The Learning Cycle

The learning cycle is a sequence of activities that involve students in the learning process. The sequence found here is based on research from Lawson**,** Abraham, and Renner published in 1989. That has been adapted to include: Explore, Apply, Extend and Assess:

Explore: Involves assessing students' prior knowledge and providing opportunities for students to interact with content from the video.

Apply: Includes having students use the content learned during the Explore section in a new way that is meaningful to future learning.

Extend: Allows students to conduct further research around an area of interest within the topic.

Assess: Provides strategies meant to inform students and teachers about the content and processes that have been learned.

Explore

The NSES Teaching Standard B states: "Teachers of science guide and facilitate learning." This standard addresses the constant need to balance your predetermined goals with allowing students to set and meet their own learning goals.

Focus and Support Inquiries: Support student inquiries by making decisions about "when to provide information" and "when to connect students with other sources." Knowing the best time to intervene is often determined by allowing students to ask questions and to explore concepts openly.

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The NSES Teaching Standard C states: "Teachers of science engage in ongoing assessment of their teaching and of student learning."

Assess in Order to Guide Teaching: The Program Overview or the Discussion Starter on the DVD can be used to gauge students' prior knowledge. You can use student responses to make decisions about appropriate instruction and adaptations in order to meet the needs of individual students. Assessment can be in the form of student reflections from standards-aligned video clips or answers to questions found on the science quiz. Or, as in the following example, a simple graphic organizer can facilitate a formative assessment.

Example: T-Chart from *Blood and Circulation*

1. Ask students to fill out the "Know-New" T-Chart (see page 14). Have them list what they already know about the circulatory system (heart, blood vessels, blood, etc.) on the left side of their charts.

2. Show the Program Overview for *Blood and Circulation*. On the right side of the chart, have students list new things they have learned from watching the clip. Walk around the room and assist students in filling in their T-Charts. Replay the program as necessary to allow students to review sections of interest.

3. Once students have completed their charts, ask them to share what they have listed in the "New" column. Write these on the board. Have students write their own working definitions of the circulatory system. Once students have completed their definitions, collect and review their work to assess prior knowledge.

Conduct direct vocabulary instruction in the Explore phase. Research suggests that:

- Students must encounter words in context more than once to learn them.
- Instruction in new words enhances learning those words in context.
- One of the best ways to learn a new word is to associate an image with it.
- Direct vocabulary instruction on words that are critical to new content produces the most powerful learning.

Use the DVD Glossary with the linked video clips to expose students to new vocabulary words in context, along with associated video images. You can also find a printed version of the glossary terms in this Guide on page 16.

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Example: Using the Glossary for Direct Vocabulary Instruction
Blood and Circulation

1. Present students with a brief explanation or description of the new term or phrase from the glossary. For example: “Capillary: A small blood vessel that connects arteries and veins.”
2. Present students with a nonlinguistic representation of the new term or phrase. Show the video clip associated with the term “capillary.”
3. Ask students to generate their own verbal description of “capillary.”
4. Ask students to create their own nonlinguistic representation of “capillary.”
5. Periodically ask students to review the accuracy of their explanations and representations. This can be done after the Apply activities.

Apply

Based on the information you gained from the Explore assessments, design appropriate activities for your students. Check the experiments listed in the Episode Guide (see page 11) for explanations of the demonstrations from the Bill Nye program as well as for additional experiments designed to help apply the knowledge gained.

In the following example from *Blood and Circulation*, the standards-based video clips provide background information, and an experiment from the Guide helps students apply what they have learned about arteries and veins.

Example: The Structure and Function of Arteries and Veins

1. Have students begin “Know-New” T-Charts, focusing on what they already know about the structure and function of blood vessels, arteries, and veins.
2. Watch the following chapters from the Bill Nye DVD *Blood and Circulation*:
   - Blood vessels
   - Heart pump and bloodstream
   - Capillaries
3. Complete the “Know-New” T-Charts.
4. Give students copies of the Student Recording Sheet (see page 15) and have them fill the sheets out as they conduct their experiments.
5. Do the experiment entitled “Pump it Up!” from the *Blood and Circulation* Episode Guide, in which students observe the apparent effects of pressure on arteries and veins.
6. Write down any remaining questions about the structure and function of blood vessels, arteries, and veins.

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Extend

The NSES Teaching Standard D states: "Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science." School administrators, parents, and the community can assist teachers in providing local resources that make science lessons pertinent and meaningful.

Identify and Use Resources Outside of the School: "The school science program must extend beyond the walls of the school." Each Bill Nye DVD contains resources designed to facilitate such understanding, including:

- Way Cool Scientist, found in both Watch Program and Bonus Materials, in which scientists discuss their current areas of study. This real-world connection often results in a deeper student understanding of a particular career.
- Disney's Edustation Web site, where relevant Internet links provide a starting point for students to further explore science topics.
- Try these video clips, with activities parents and students can do at home. The questions generated by students from these experiences can be used as foundations from which they may conduct their own research.
- Standards-aligned video clips and Bill's demonstration video clips, which can help generate topics for further research. After viewing the clips, have students list their questions, perhaps about the most current developments in a topic. By conducting online or library research, students will find answers to their questions and will learn about a topic in greater depth.

Example: Conducting Student Research Using *Blood and Circulation*

Ask students to choose one of the questions they had after completing the activities from *Blood and Circulation*. An example of a student research question might be, "How has the technology related to artificial hearts advanced in the last ten years?" Explain to students that they will be conducting research to find answers to their questions. Some students may want to complete online or library research, others may want to ask an expert in the field, while others may want to design and conduct a scientific investigation. Encourage students to write a detailed procedure for finding answers to their questions. Ask students to find one or more examples of current research dealing with the circulatory system that is related to their question. NOTE: Students with similar questions may work together to complete the assignment.

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Assess

Once students have conducted the research, you may choose to assess them in a number of different ways:

- By having students write about what they learned in a journal.
- By having students submit projects or reports.
- By having students take the program quiz to gauge their understanding of certain facts in the video. You can either print the quiz (found in this Guide on page 18) and have each student complete it individually or use the DVD screen version and the scoring feature for whole-class assessment.
- By designing other standards-aligned questions to augment those that are provided.

While the quiz will provide you with information about what the students have learned, it does not assess how students have processed the information. Below you will find assessment ideas that can be used to measure both content and process.

A Sample Assessment for *Blood and Circulation*

1. Explain to students that an important aspect of scientific inquiry is to communicate findings to others. In this assessment, students will present the following information to their peers:
   - The question they investigated.
   - The method that was used to find answers to their question.
   - Problems or successes during the search.
   - Answers to their question.
   - Current research related to their question.
   - New questions that have arisen.
2. Distribute the rubric found in the Lesson Planning Worksheet (see page 13) to students so they know how they will be assessed. Make sure students understand the criteria found in the rubric. Before you begin, you may want to allow students to make changes to the rubric so that it is clearer or makes more sense from their perspectives.
3. Allow students time to gather information to answer their questions and to prepare for their presentations. As students conduct this work, walk around the room and ask questions to assess their progress and provide input as needed.
4. Take a few minutes to clarify the rules of the presentation with the students. You may want to have multiple copies of the rubric available so that peers can rate the presentations.
5. As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can.

Congratulations! You have now completed the steps to set up a lesson plan using the Lesson Planning Worksheet. You have also explored many of the features of the Bill Nye DVD as well as the supplemental information found in this Teacher's Guide. And most important, you've made significant strides toward incorporating DVD technology into your day-to-day instruction.

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National Science Education Standards

Space Exploration

Standards/Benchmarks – Grades 5-8

Science as Inquiry

Understandings about scientific inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Mathematics is important in all aspects of scientific inquiry.
- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.
- Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data. All of these results can lead to new investigations.

Physical Science

Motions and forces

- The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.
- An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.
- If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.

Transfer of energy

- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
- Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
- In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.

Earth and Space Science

Earth in the solar system

- Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.
- Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface and explains the phenomena of the tides.

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Science and Technology

Understandings about science and technology

- Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.

- Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.

History and Nature of Science

Science as a human endeavor

- Women and men of various social and ethnic backgrounds—and with diverse interests, talents, qualities, and motivations—engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.

- Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

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Episode Guide

Space Exploration

Nifty Questions in This Episode	Awesome Answers
Is all the light in the night sky from the stars?	No! Some light is from planets.
What is the name of the instrument that we use for looking at the stars and planets?	Telescope.
Is there air to breathe in space?	No! Space is a vacuum.
What is the name of the largest U.S. rocket used for space exploration?	Saturn 5.

Experiments shown on the video:

NONE

More interesting stuff to do:

TRAVEL LIGHT

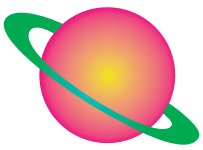
Objective: To demonstrate that light travels in a straight line.

- Use a cylinder-shaped “rolled oats” breakfast cereal container (or coffee can). Poke a hole in the middle of the lid with an ice pick or nail.
- In a dark room, cut photo-sensitive paper (photographic paper) to fit in the bottom of the container.
- Place objects on the paper at the bottom of the container.
- Replace lid and cover the hole with a piece of clay or black tape.
- Place container in the sunlight and remove the clay or tape without moving the container.
- Let stand for a few minutes undisturbed.
- Return container indoors. Remove lid and contents to view the resulting photograph.

YOU SEE WHAT YOU GET

Objective: To demonstrate how light is refracted in a telescope.

- Cut a circular piece of black construction paper big enough to fit over the lens of a 6-volt flashlight.
- Draw a triangle in the middle of the paper and cut it out.
- Tape the black paper to the flashlight lens with the triangle in the middle of the lens.
- Hold a magnifying lens in front of the flashlight and project the image through the lens onto a wall.
- Move the magnifying lens back and forth until the projected image becomes clear and upside-down.



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Lesson Planning Worksheet

Lesson Title _____

Objectives _____

_____

_____

Estimated Time Required _____

Materials Needed _____

_____

National Science Educational Standards

_____

_____

_____

_____

_____

Explore _____

_____

_____

_____

Apply _____

_____

_____

_____

Extend _____

_____

_____

_____

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Assess

As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can. The following criteria can be used to assist in your assessment.

Name of Student _____

Question Investigated _____

Initial Question			
1 Question is broad and not well defined	2 Question is defined but limited to single-answer responses.	3 Question is clear and might elicit multiple responses that may lead to new ideas and additional questions.	4 Question is engaging and provokes new ways of thinking about an issue.
Methods for Finding Answers			
1 Students do not share planned or actual methods.	2 Students share methods but they are unclear or vague.	3 Students share methods but not the problems or successes of using the methods.	4 Students share methods and problems or successes in using the methods.
Results			
1 Student results are undefined.	2 Student results are incomplete and do not adequately answer the question.	3 Student results are complete, adequately answer the question, and include current research related to the question.	4 Student results are complete, include current research, and have resulted in one or more additional questions.
Communication			
1 Student is not prepared to speak.	2 Presenter has distracting mannerisms and avoids eye contact with the audience.	3 Presentation is clean and clear with some eye contact and very few distractions.	4 Presentation is exceptional and unique. Presenter uses regular eye contact and avoids distractions.

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Student "Know / New" Chart

Know	New
Write down what you know about the topic of the video.	Write down information from the video that is new to you.

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Student Recording Sheet

Name _____ Date _____

Title of Experiment _____

Question: (What are you testing?) _____

Procedure: (Describe the experiment) _____

Materials: (List what you used) _____

Observations: (Record what happened) _____

Results: (Make your own data table)

Conclusions: (Use your observations and results to describe what you learned)

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Glossary

Space Exploration

Fold and cut to use as flashcards.

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TELESCOPE

Telescope

An instrument that makes distant objects appear nearer and larger.

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PLANETS

Planets

The nine large bodies that revolve about the sun and shine by reflected light.

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MOONS

Moons

Naturally occurring objects that revolve about planets.

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REFRACTOR TELESCOPE

Refractor Telescope

A telescope that bends or refracts light to bring a distant image into focus.

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Fold and cut to use as flashcards.

Bill Nye the Science Guy

HUBBLE SPACE TELESCOPE

Hubble Space Telescope

A telescope that has been placed in orbit around the Earth.

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GRAVITY

Gravity

The force of attraction that exists between all bodies.

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ORBIT

Orbit

The curved path taken by a planet, moon, satellite around another celestial body.

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GANTRY TOWER

Gantry Tower

A frame used to hold rockets while preparing for lift-off.

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Fold and cut to use as flashcards.

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VACUUM

Vacuum

A void, empty space.

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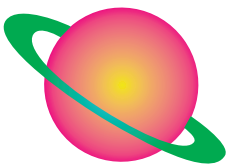
SPACE SUIT

Space Suit

A specially designed pressure suit that is worn by astronauts in the vacuum of space.



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Name _____ Date _____

Quiz

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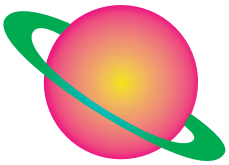

True or False? Circle T or F

1. Spaceships orbit the Earth in a circular motion. T or F

2. Liquid-cooling water in spacesuit garments is used to regulate heat and keep astronauts comfortable in the extreme temperatures of space. T or F

3. A small number of people are needed to fly a space mission. T or F

4. Solar flares cannot change the direction of a spacecraft. T or F

5. Telescopes allow astronomers to make new discoveries which result in the need for even more sophisticated telescopes. T or F

6. Very little energy is used during a rocket launch. T or F

7. Special tiles help dissipate (break up) the heat of a space shuttle upon re-entry into the Earth's atmosphere. T or F

Multiple Choice: Circle the letter of the best answer

8. What is the force that holds objects (like a spacecraft) to the Earth's surface?
   A. Vacuum
   B. Acceleration
   C. Mass
   D. Gravity

9. Which of the following best describes the motion of an orbiting spacecraft?
   A. Straight line
   B. Circular
   C. Zigzag
   D. None of the above

10. Which of the following is a description of the two forces acting on an orbiting spacecraft?
    A. They are balanced.
    B. They do not act on the spacecraft.
    C. They reinforce one another.
    D. None of the above.

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Answer Key

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1. T	4. F	7. T	9. B
2. T	5. T	8. D	10. A
3. F	6. F		

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